TECHNICAL MANUAL

Model: surveyor 50™
Portable Survey Meter

Manual Part No. 1002907

Issue	Date
Original	1/83
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Bicron Corporation
12345 Kinsman Road
Newbury, OH 44065
Telephone: (216) 564-8000
Telex: 980474 BICRON NWBY
Telefax: (216) 564-8047

Bicron Corporation
European Office, P.O. Box 271
2410 AG Bodegraven The Netherlands
Telephone: 1726-14243
Telex: 39772 BICIN NL
Telefax: 1726-14316

ELECTRONIC PRODUCTS
STANDARD WARRANTY

Instruments and options manufactured by Bicron are warranted against defects in materials and workmanship for a period of two years from the date of shipment, unless otherwise agreed upon by Bicron and the customer.

Bicron's obligation with regard to such products shall be limited to repair or replacement, FOB Bicron factory or authorized repair station, at Bicron's option.

The calibration (when applicable) for each instrument is warranted to be within its specified accuracy at the time of shipment. If this initial calibration is determined to be in error, the instrument will be recalibrated at no charge, provided it is returned as described above.

EXCLUSION OF WARRANTY

The aforesaid warranty does not cover instruments, options or probes which are subject to excessive physical abuse or are used for purposes other than those intended. In no event shall Bicron be liable for consequential or special damages, transportation, installation, adjustment, work done by customer or other expenses which may arise in connection with such defective product or parts.

There are no warranties, express or implied, including without limitation any implied warranty of merchantability or fitness, which extend beyond the description of the face hereof. This express warranty excludes coverage of and does not provide relief for incidental or consequential damages of any kind or nature, including, but not limited to loss of use, loss of sales or inconvenience. The exclusive remedy of the purchaser is limited to repair, recalibration, or replacement of the instrument at Bicron's option.

This warranty specifically excludes the following items which are covered by their original manufacturer's warranties: photomultiplier tubes, GM and proportional tubes, crystal and other solid-state detectors, and batteries.

BICRON CORPORATION
ELECTRONIC PRODUCTS

PROCEDURES and CAUTIONS

The equipment herein described is designed and manufactured in compliance with all applicable safety standards. Nevertheless, certain hazards are inherent in the use of electronic and radiometric equipment.

Adequate warnings are included in the manual and on the product itself to cover hazards that may be encountered in normal use and servicing of this equipment. No other procedures are warranted by Bicron.

It shall be the owner's or user's responsibility to see to it that the procedures and cautionary notes are heeded.

Failure on the part of the user in any way to follow the prescribed procedures shall absolve Bicron and its agents from any resulting liability.

This instrument is intended solely for the detection and measurement of ionizing radiation. It should be used only by persons who have been trained in the proper interpretation of its readings and the appropriate safety procedures to be followed in the presence of radiation.

All instructions and warnings contained in this manual or on the instrument must be read before use and must be strictly followed. Failure to follow these instructions and warnings may result in inaccurate readings and/or user hazard.

Indicated battery and other operational tests must be performed prior to each use to assure that the instrument is functioning properly.

*****CAUTION*****

FAILURE TO CONDUCT PERIODIC PERFORMANCE TESTS IN ACCORDANCE WITH ANSI N323-1978, PARAGRAPHS 4.6 AND 5.4, AND TO KEEP RECORDS THEREOF IN ACCORDANCE WITH PARAGRAPH 4.5 OF THE SAME STANDARD, COULD RESULT IN ERRONEOUS READING OF POTENTIAL DANGER. ANSI N323-1978* BECOMES, BY THIS REFERENCE, A PART OF THIS OPERATING PROCEDURE.

INSPECTION

Instruments should be examined and tested as soon as received. Claims for transportation damages, if any, should be filed at once with the delivery carrier.

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* American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

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1.0 GENERAL DESCRIPTION

The Bicron surveyor 50 is a portable survey meter designed for use with an appropriate GM probe to detect and measure ionizing radiation.

The instrument features a recessed meter movement, laminated control panel, cpm and mR/h meter scales, single on-off/range selector switch, MHV probe connector and mounted probe holder.

Advanced circuit design provides a detector HV check, anti-saturation, dead time compensation, and response time optimized for each range. Built in audio is available.

1.1 SPECIFICATIONS

RADIATION DETECTED: Alpha, beta, gamma, and x-ray, depending upon detector used

RANGE: Three linear ranges of 0-0.5, 0-5, 0-50 mR/h with SWGM or EWGM probe; 0-600, 0-6000, 0-60,000 CPM

ACCURACY: Within 10% of reading for ^{137}Cs when calibrated according to NRC Reg. Guide 10.8

DETECTOR: Choice of GM probes

HIGH VOLTAGE: Electronically stabilized, factory set at 900 V

HV TEST: Exclusive self test to verify detector HV power supply

CONNECTOR: MHV

WARMUP TIME: None

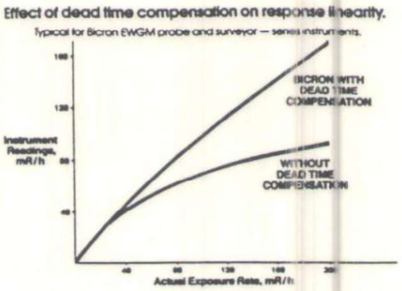
SATURATION: Exclusive anti-saturation circuit provides saturation typically > 1000 R/h for most GM probes; > 5 R/h for pancake GM probes

RESPONSE TIME: Optimized for each range 0-90% of final reading as follows:

Range	Time
0.5 mR/h	12 sec.
5 mR/h	5 sec.
50 mR/h	2 sec.

DEAD TIME COMPENSATION: Exclusive circuitry provides a near linear response.

FIGURE1



TEMPERATURE: Operational from -40° C to +60° C

HUMIDITY: < 5% change in reading from 10-95% RH

CONTROL: Six-position rotary switch - off, bat. HV, X100, X10, X1

BATTERY COMPLEMENT: Single 9-Volt (MN1604 or equal). The additional battery holder may be used as storage for spare or parallel-wired

BATTERY LIFE: > 100 hours or > 200 hours with parallel option

DISPLAY: Ruggedized, recessed, high-torque 1 mA meter with 3.35 inch (8.51 cm) scale marked 0-0.5 mR/h, 0-600 CPM, 'Bat. ok', 'HV ok'. Meter protected by impact-resistant Lexan® polycarbonate window

GEOTROPISM: Within +/- 2% of full scale

SHOCK: 100 g per lightweight machine of MIL-STD 202C, method 202B

VIBRATION: 5 g in each of three mutually orthogonal axes at one or more frequencies from 10-33 Hz

CONSTRUCTION: Splash-proof, shock-proof, two-piece all-metal case. Scratch-resistant laminated control panel and Bicron Kleen-Krome® trim on case top, durable black polyurethane paint on handle and case bottom. Stainless steel probe clip on handle.

AUDIO OPTION: When specified, the unit is equipped with a built-in speaker controlled by a panel mounted on-off switch. This speaker provides an audible "click" for each detector pulse or (if desired) an audible over-range alarm signal.

SIZE: 4.25" x 8" x 6.8" including handle and probe clip (10.8 x 20.3 x 17.3 cm)
WEIGHT: 2.2 lbs. (1 kg), excluding probe

2.0 BATTERY INSTALLATION

BATTERY TYPE: 9-volt Mallory MN1604 or equivalent.
PROCEDURE:

1. Turn instrument off.
2. Open pull catches at ends of case and separate case bottom from top.
3. Install battery in appropriate clip on bottom circuit board (clip for spare battery is so marked), observing proper polarity.
4. Replace bottom, orienting rubber under battery; close catches.

PARALLEL-WIRED OPTION: Instruments with this option have both battery clips wired into the circuit. Installing a second battery thus provides twice the operational hours of one battery. Only one battery is needed to power the instrument, however.

2.1 BATTERY TEST

Turn control switch to the "bat." position; a meter reading within the "bat. OK" range should be observed.

This test allows monitoring of the condition of the battery.

2.2 HIGH VOLTAGE TEST

Turn control switch to the "HV" position; a meter reading within the "HV OK" range should be observed.

This test allows monitoring of the high voltage to the detector.

2.3 RADIATION MEASUREMENTS

To make a radiation measurement:

1. Select a GM probe appropriate to the survey situation and attach it to the instrument via a cable (connection is so marked).
2. Turn the selector switch to one of the linear ranges (X1, X10, or X100).
3. Multiply the meter scale reading X the selector position to obtain the reading.
4. Read the mR/h scale (the top meter scale) when using a SWGM or EWGM probe calibrated with the unit for ^{137}Cs (standard calibration). The serial number of the instrument and the probe appear on the calibration certificate.

   When using other GM probes (such as pancake types) or a SWGM or EWGM not calibrated in mR/h with the instrument, read the counts per minute scale (the bottom meter scale).

*****CAUTION*****

An external source of ionizing radiation of the type the count rate meter and the GM probe selected were designed to measure must be used to determine proper operation of this instrument.

2.4 AUDIO OPTION

If the instrument is equipped with this option:

1. An internal speaker will produce an audible click for each detector pulse. This speaker is controlled by a panel mounted on-off switch labeled "audio".
2. An audible alarm will sound when the meter is approximately 30% or more above full scale on any range. This over-range alarm can be defeated by turning off an internal on-off switch located on the main circuit board.
3. The over-range alarm will function only when the panel mounted "audio" control is in the off position, and the internal switch is on. When the speaker control is in the on position, the over-range alarm is defeated.

3.0 CIRCUIT DESCRIPTION

The electronic circuitry is contained on three interconnected printed circuit boards.

Modern solid-state integrated circuitry is used throughout. The major components are:

1. The high-voltage power supply which is a feedback-regulated, electronically stabilized supply for the GM tube potential. Additional circuitry provides an HV test readout on the meter scale.
2. The count-rate meter which is a linear charge pump ratemeter that converts the

GM tube pulses to an exposure rate reading on the calibrated meter scale. The circuitry includes a unique dead-time compensation technique to provide nearly linear response over the full range, an anti-saturation circuit which forces the meter beyond full scale in high radiation fields, automatic time constant selection, and temperature compensation.

3. The optional audio circuitry for individual pulse counting and over-range alarm.

3.1 GM TUBE (PROBES)

The GM tube consists of a thin shell which acts as the cathode, a fine wire anode suspended within the shell, and an inert gas into which a small amount of a halogen gas has been mixed to act as a quenching agent. End window and pancake tubes have a thin mica entrance window.

A potential of approximately 900 volts is maintained between the two electrodes. This voltage is slightly less than that required to produce a discharge in the gas. When a nuclear particle or ray of sufficient energy enters the GM tube, it ionizes a molecule of the inert gas. The positive ions are attracted to the cathode and the electrons are attracted to the anode because of the high voltage maintained between the electrodes. In their movement toward the electrodes, these charged particles trigger the ionization of additional gas molecules, resulting in an avalanche of ions flowing between the electrodes. The gas discharge thus created is similar to the glow of a neon lamp. The tube conducts as long as the gas is in the ionized state.

The small amount of halogen gas in the gas mixture quenches the flow of ions, suppressing further electron avalanches until another nuclear particle or ray enters the tube. This flowing and quenching results in a rapid pulse or surge of current in the external circuit. The number of pulses per minute is approximately proportional to the radiation exposure rate. The meter, suitably connected to the tube, indicates the exposure rate or counts per minute (depending on probe used) on a calibrated scale.

4.0 CALIBRATION

A. Standard (mR/H)

The instrument is normally factory calibrated with a specific model SWGM (side wall GM) or EWGM (end window GM) probe using ^{137}Cs gamma rays. Recalibration is required (a) after servicing, (b) if the GM probe is replaced, and (c) at regular intervals specified by the appropriate regulatory agencies.

The SWGM (with shield closed) or EWGM probe is placed in a known radiation field with the axis of the probe perpendicular to the beam.

Individual calibration controls are provided for each range, and are used to adjust the meter reading to correspond to the known exposure rate. The locations of these controls are shown on a label in the case bottom.

Note:
Do not disturb the settings of any controls except those marked X1, X10, and X100.

Calibration procedures should follow those specified by the appropriate regulatory agencies.

B. OPTIONAL (CPM) CALIBRATION

Electronic calibration (counts per minute) is the only type that can be done when GM probes other than a specific SWGM or EWGM are supplied, or when the instrument is not supplied with a specific probe.

When an electronic calibration is performed, the unit is connected to a variable frequency pulse generator. The generator is then set at the frequencies needed to produce 70% and 30% of full scale meter readings (cpm) for each range. Calibration controls are set for 70% of full scale readings, and linearity is checked by going to the 30% readings.

C. Detailed calibration procedures are part of the Q. C. Acceptance Procedure found elsewhere in this manual.

BICRON QC ACCEPTANCE PROCEDURE NUMBER 1002937

MODEL: surveyor 50™

1. Perform a visual inspection of finished product.

2. Remove all 9V batteries and connect a 9.30V +/- .05V power source across the main battery terminals on the battery board. Perform the following calibrations:

   a. Turn the control switch to "off". Mechanically zero the meter via the rear zero adjustment screw on the meter barrel.

   b. Turn the control switch to "X100". Check the +5V supply at pin 1 of U6 (ICL 7663). The reading should be 5VDC +/- 10%.

   c. Leave the control switch set at "X100" and connect a voltmeter between pins 1 (ground) and 15 of the 24 pin connector. Adjust R31 (50Kohm zero pot) until the voltmeter reads 1 mVDC + 2 1/2/-1.

   d. Turn the control switch to "HV" and connect a high voltage measuring device with an impedance > or =1000 megohms to the probe connector center pin. Adjust the high voltage supply via R45 (50 Kohm pot) to + 900 VDC +/- 3%.

   e. Leave the control switch in "HV" and adjust R29 (500 ohm span pot) until the meter reads in the center of the "HV ok" checkband.

   f. Perform a CPM calibration (unless isotopic calibration is specified).

      1) Turn the control switch to "X100" and connect a variable frequency pulse generator to test point 2 (pin 5 of the 24 pin connector).

      2) Adjust the frequency to the value needed to calibrate at 70% of full scale on the meter (see Table T-1).

      3) Adjust R19 (50 Kohm X100 calibration pot) until the meter reads 70% of full scale.

      4) Readjust the frequency to the value needed to calibrate at 30% of full scale and note the meter reading.

      5) If the reading is within the acceptable range listed in Table T-1, note the meter readings from steps 3 and 4 on a Certificate of Calibration. If not, readjust the frequency to the 70% value and adjust R19 to produce a different reading within the acceptable range.

      6) Repeat steps 4 and 5 until the meter readings obtained are within the acceptable ranges for both the 70% and 30% of full scale calibration points.

      7) Repeat steps 2, 3, 4, 5 and 6 (if necessary) for the X10 range (using R17, the 500 Kohm X10 calibration pot), and the X1 range (using R15, the 5 megohm calibration pot).

TABLE T-1

Range	Pulse Generator Output (Hz)	Simulated cpm	Acceptable Meter Reading (cpm)
X100 (70%)	657	42,000	37,800 - 46,200
X100 (30%)	292	18,000	16,200 - 19,800
X10 (70%)	70	4,200	3,780 - 4,620
X10 (30%)	30	1,800	1,620 - 1,980
X1 (70%)	7	420	378 - 462
X1 (30%)	3	180	162 - 198

Note: The values in this table may not correspond to those for other Bicron or competitive models.

g. If specified to be supplied with an SWGM or EWGM probe, perform an isotopic calibration:

1. Connect the GM probe to the probe connector via a cable.

2. Place the probe in a known ^{137}Cs radiation field in a fixed geometry.

3. Calibrate each range at 70% and 30% of full scale using the values in Table T-2 and the same calibration pots as those listed for a CPM calibration.

TABLE T-2

Range	Field Strength (mR/h)	Acceptable Meter Reading (mR/h)
X100 (70%)	35	31.5 - 38.5
X100 (30%)	15	13.5 - 16.5
X10 (70%)	3.5	3.15 - 3.85
X10 (30%)	1.5	1.35 - 1.65
X1 (70%)	.35	.315 - .385
X1 (30%)	.15	.135 - .165

h. Mark all trimpot bodies in such a way as to show the general position of the adjustment screws after calibration.

3. If the unit is equipped with the audio option, test as follows:

a. Connect a variable frequency pulse generator to pin 5 of the 24 pin connector.

b. Turn the audio switch to "on" and check to see that the audio functions properly on all three ranges, using the pulse generator. Also, check that the audio remains silent when the selector switch is on "bat." and "HV".

c. Turn the audio switch to "off" and the alarm on/off switch mounted on the main PC board to "on". Drive the meter well beyond full scale with the pulse generator and observe that a continuous tone is heard. Do this on all three ranges.

d. Disconnect the pulse generator.

4. Test anti-saturation circuit operation as follows:

   a. Turn the control switch to "X100" and connect a 1000 megohm resistor across the probe connector (from + 900V to ground). The meter should peg beyond full scale.

   b. Replace the 1000 megohm resistor with a 2000 megohm resistor. The meter should remain at zero.

   c. Remove the 2000 megohm resistor.

5. Perform the following test if a CPM calibration was done:

   a. Leave the control switch on "X100" and turn the audio switch on.

   b. Connect a suitable GM probe to the instrument.

   c. Place a small check source near the probe and switch to each of the three ranges in turn. A meter reading should be obtained for each range.

6. Remove all test equipment from the unit. Turn the control switch to "off" and install a new + 9V alkaline battery (MN-1604 or equivalent) in the appropriate battery clip (either clip if the unit has the parallel-wired battery option).

7. Complete, date and sign a Certificate of Calibration.

SPARE PARTS LIST
BICRON surveyor 50

SCHEMATIC SYMBOL	DESCRIPTION			PART NO
	Main PC Board Assembly			1002017
C1, C22	Capacitor,	0.1 uF,	Film	9211041
C2, C18, C19	Capacitor,	.001 uF,	1 kV cer.	9201021
C3	Capacitor,	.001 uF,	Film	9211021
C5, C20	Capacitor,	33 uF,	10 V tan.	9233361
C6, C7, C23	Capacitor,	.01 uF,	Film	9211031
C9, C25	Capacitor,	1 uF,	35 V tan.	9231051
C10, C13, C17	Capacitor,	.22 uF,	Film	9212241
C12, C21, C24	Capacitor,	.047 uF,	Film	9214731
C14	Capacitor,	220 pF,	N750 cer.	9202211
C15, C16	Capacitor,	.01 uF,	1 kV cer.	9201031
C26	Capacitor,	.0033 uF,	Film	9213321
D1-D10, D13-D17, D20	Diode,	1N4148		9600004
D11, D12	Rectifier,	2 kV PIV		9600001
Q1	Transistor,	2N4124		9610001
Q2	Transistor,	2N5210		9610005
Q3	Transistor,	2N4126		9610002
R1	Resistor,	10k,	1/4w, 5%	8110022
R2	Resistor,	390 ohms,	1/4w, 5%	8139002
R3	Resistor,	27k,	1/4w, 5%	8127024
R4	Resistor,	1k,	1/4w, 5%	8110012
R5	Resistor,	4.7k,	1/4w, 5%	8147012
R6, R20, R56, R57	Resistor,	10k,	1/4w, 5%	8110024
R7, R8	Resistor,	4.7k,	1/4w, 5%	8147014
R9, R28	Resistor,	82.5k,	1/4w, 1%	8582524
R11, R12, R22	Resistor,	100k,	1/4w, 5%	8110034
R13, R50	Resistor,	274k,	1/4w, 1%	8527434
R14	Resistor,	4.99 meg,	1/4w, 1%	8549941
R15	Trimpot,	5 meg		9395051
R16, R38	Resistor,	499k,	1/4w, 1%	8549934
R17	Trimpot,	500k		9395041
R18	Resistor,	49.9k,	1/4w, 1%	8549924
R19, R31, R45	Trimpot,	50k		9395031
R23, R34, R35, R36, R41, R47, R51, R52, R55	Resistor,	1 meg,	1/4w, 5%	8110044
R24, R40, R44, R54	Resistor,	470k,	1/4w, 5%	8147034
R27	Resistor,	4.99k,	1/4w, 1%	8549914
R29	Trimpot,	500 ohm		9395011
R30	Resistor,	249 ohm,	1/4w, 1%	8524904
R32	Resistor,	1 meg,	1/4w, 1%	8510044
R33	Resistor,	11k,	1/4w, 1%	8511024
R37	Resistor,	1000 meg,	1%	8810071
R39	Resistor,	33.2k,	1/4w, 1%	8533224
R42	Resistor,	1k,	1/4w, 5%	8110014
R43	Resistor,	2.7k,	1/4w, 5%	8127014
R46	Resistor,	200k,	1/4w, 1%	8520034
R48	Resistor,	100k,	1/4w, 1%	8510034
R49	Resistor,	23.7k,	1/4w, 1%	8523724
RN1	Res. Network,	7 x 220k		8822031
SW3	Switch,	Slide,	SPST	9550001

U1	Int. Ckt.,	MC3302PDS		9640002
U2	Int. Ckt.,	MC14538BCPDS		9650004
U3	Int. Ckt.,	MC14093BCPDS		9650001
U4, U5	Int. Ckt.,	CA3160BEX		9640001
U6	Int. Ckt.,	ICL7663CPA		9640003
U7, U8	Int. Ckt.,	CD4016BEX		9650002
XFMR	Transformer,	M8149		9500001
	Connector,	24-pin		9780001

	Switch PC Board Assembly			1002027
R26	Resistor,	681 ohm,	1/4w, 1%	8568104
SW2	Switch,	Rotary,	2 pos.	9560003
SW5	Switch,	Rotary,	2-7 pos.	9560001
	Sounder			9720001
	Header,	24-pin		9780002

	Battery PC Board Assembly	9420001

	Case Top Assembly	1002147
	Handle	9710002
	Meter	9400003
	Meter Window	9400011
	Meter Support Bracket	9850002
	MHV Connector	9782001
	Probe Clip	9460004

	Case Bottom Assembly	1002050

	Miscellaneous	
BT1	Battery, 9V alkaline, MN1604	9750001
	Cable, Probe, MHV-MHV, 36-inch	9801001
	Knob, Function	9770003
	Knob, Round, w/pointer	9770001
	Manual, Instruction	1002907
	Spare Parts List	1002917
	Schematic Circuit Diagram	1002927
	QC Acceptance Procedure	1002937

Part No. 1002917

Issue:	Date:
Original	04/23/84
Rev. A	08/02/85
Rev. B	03/14/86
Rev. C	10/21/86

.., R2, R4, R5
). (VERTICAL)

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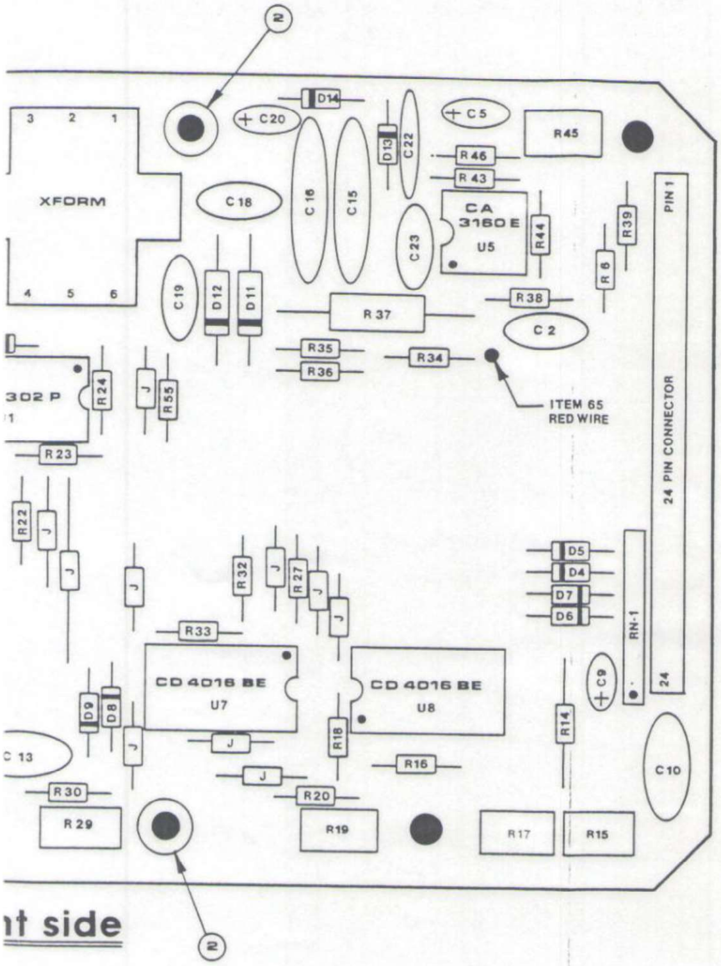

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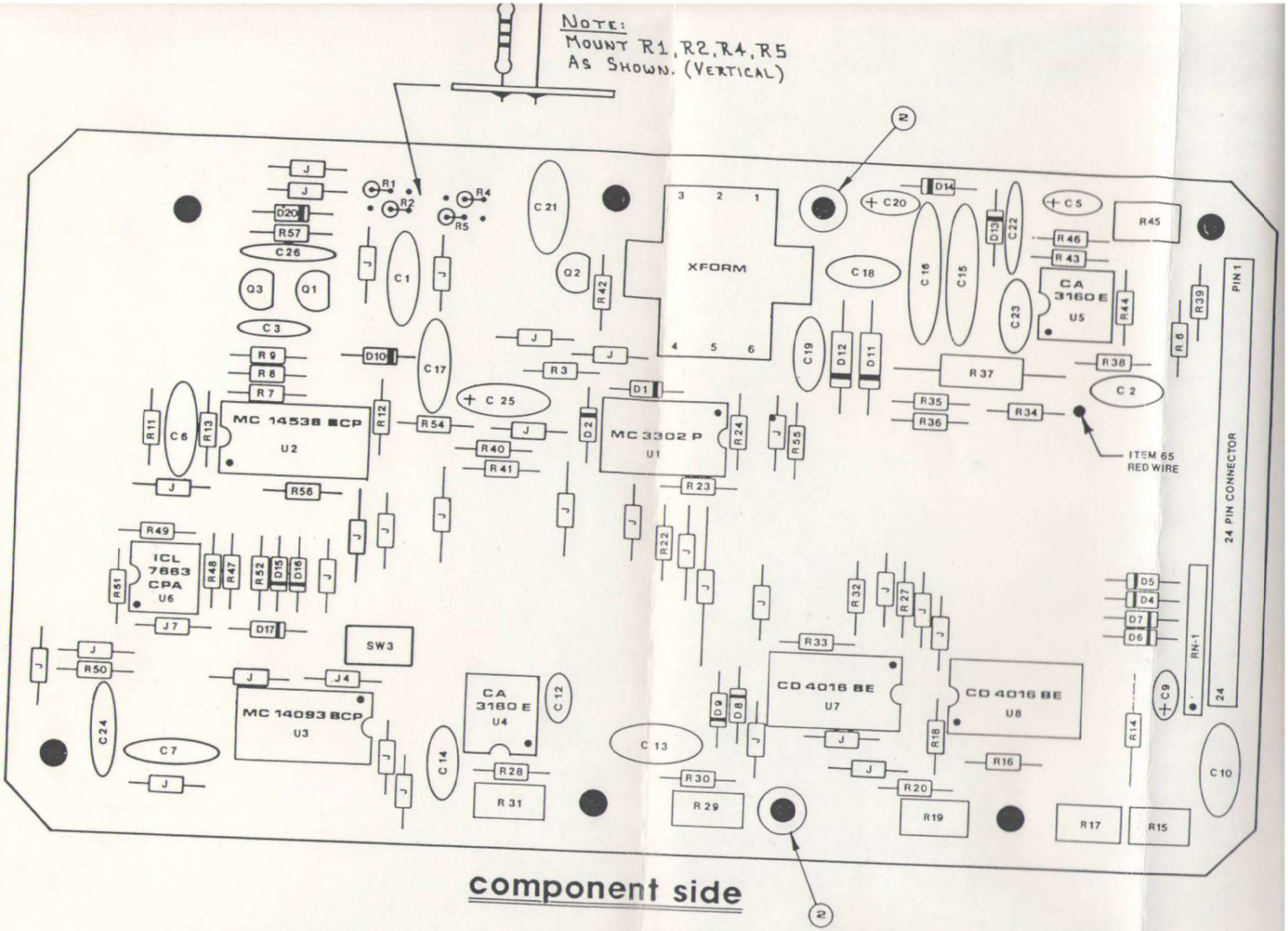
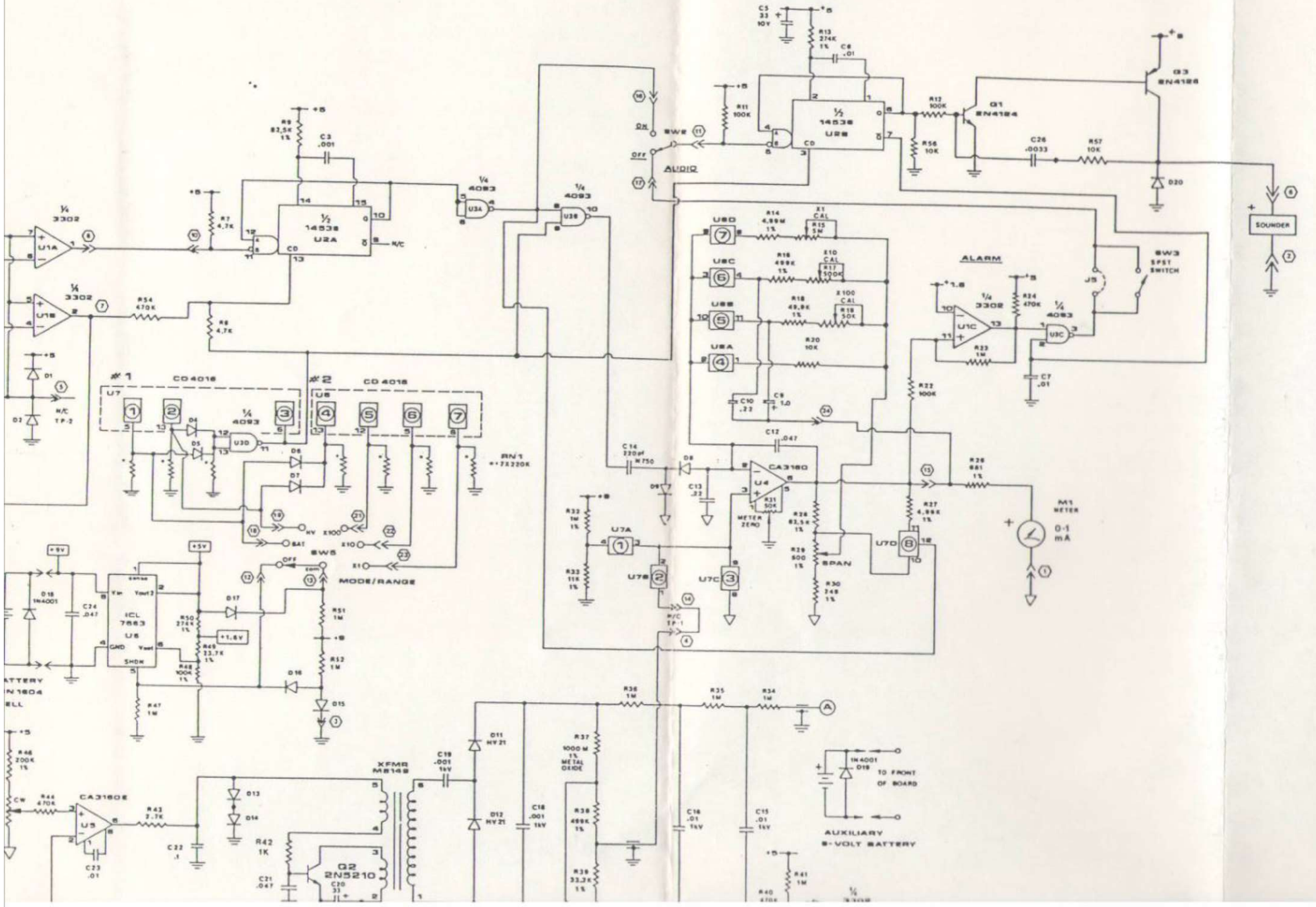
LESS IFIED	SCALE: NONE	BICRON CORPORATION NEWBURY. OHIO U.S.A.
	DRAWN: DATE 10/24/83	
	CHECKED: DATE	
	DO NOT SCALE PRINT	MAIN BOARD ASSEMBLY
	FINISH SPEC.	SURVEYOR AHS
EAK		DRWG. NO. 1002017 REV. B

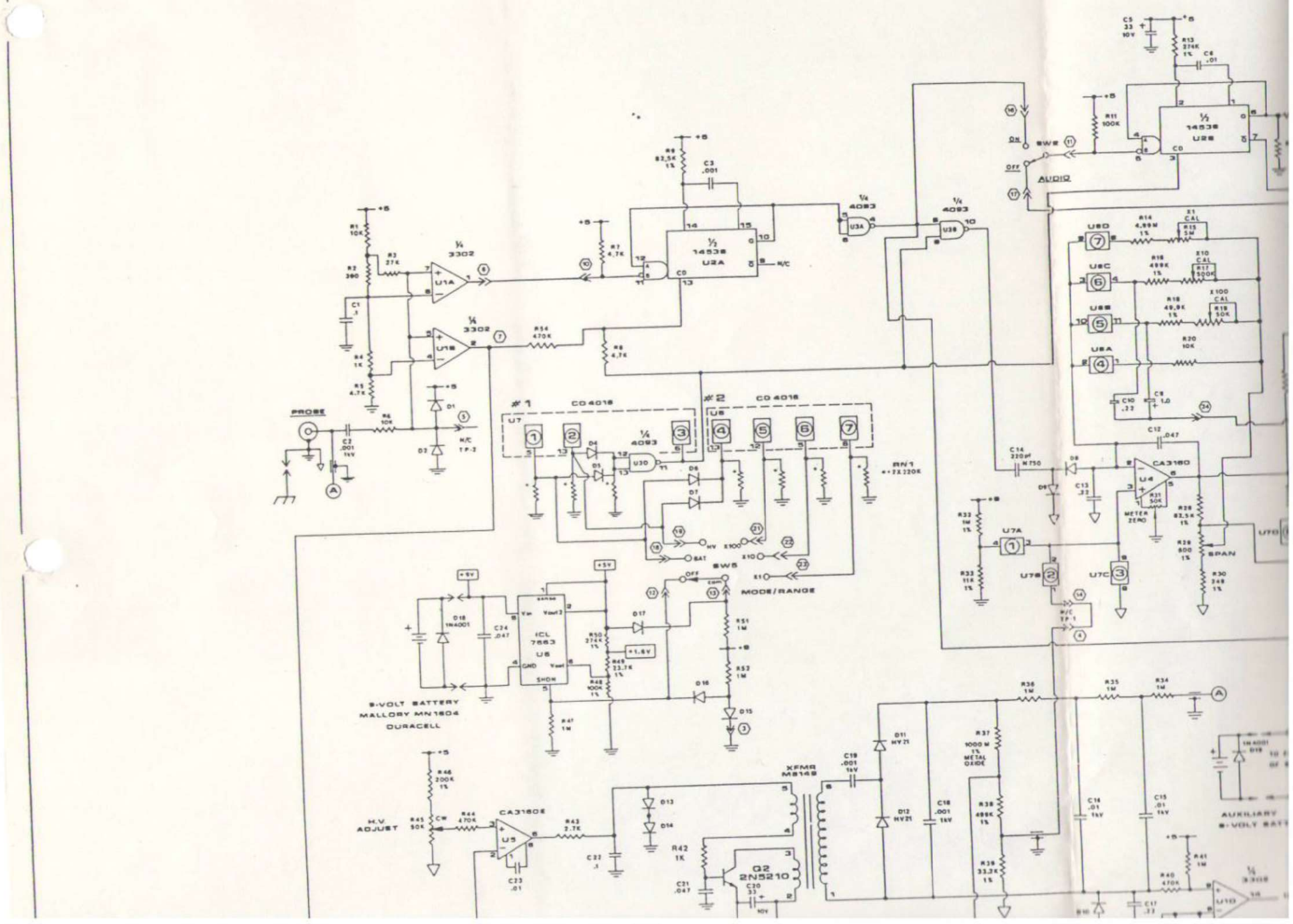


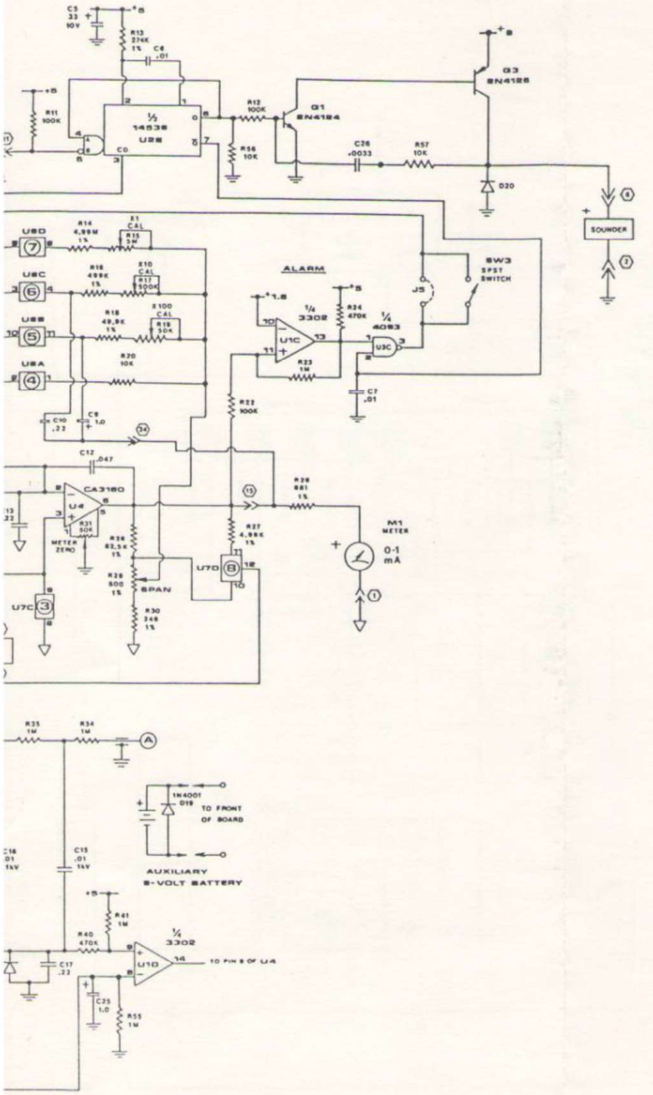
NOTE:
MOUNT R1, R2, R4, R5
AS SHOWN. (VERTICAL)

component side



ALARM
AUDIO
SOUNDER
SW2
SW3
SPST SWITCH
SW5
MODE/RANGE
J5
M1 METER
0-1 mA
SPAN
METER ZERO
Q1 2N4124
Q3 2N4126
Q2 2N5210
XFMR M8148
½ 14538 U2A
½ 14538 U2B
¼ 4093
¼ 3302
U1A
U1B
U1C
U3A
U3B
U3C
U3D
CA3160
U4
CA3160E
U5
ICL 7663
U6
CD4016
#1
#2
RN1
AUXILIARY
9-VOLT BATTERY
TO FRONT OF BOARD
1N4001
D19
ON
OFF
HV
BAT
X100
X10
X1
N/C
TP-1
TP-2
+1.8V
+5V
R37
1000 M
1%
METAL OXIDE


PROBE
C2 .001 1kV
R6 10K
N/C TP-2
D1
D2
+5
R1 10K
R2 390
R3 27K
C1 .1
R4 1K
R5 4.7K
¼ 3302
U1A
U1B
R54 470K
R7 4.7K
R8 4.7K
R9 82.5K 1%
C3 .001
½ 14538
U2A
CD
N/C
¼ 4093
U3A
U3B
U3D
# 1
U7
CD 4016
# 2
U8
D4
D5
D6
D7
RN1
HV
BAT
X100
X10
X1
OFF
com
SW5
MODE/RANGE
+5V
D18 1N4001
C24 .047
ICL 7663
U6
Vin
Vout 2
Vout
GND
SHDN
sense
R50 274K 1%
R49 23.7K 1%
R48 100K 1%
R47 1M
+1.6V
D17
D16
D15
R51 1M
R52 1M
+9
9-VOLT BATTERY
MALLORY MN1604
DURACELL
H.V. ADJUST
R46 200K 1%
R45 50K
CW
R44 470K
CA3160E
U5
C23 .01
R43 2.7K
C22 .1
D13
D14
R42 1K
C21 .047
Q2 2N5210
C20 33 10V
XFMR M8149
C19 .001 1kV
D11 HV21
D12 HV21
C18 .001 1kV
R37 1000 M 1% METAL OXIDE
R38 499K 1%
R39 33.2K 1%
R36 1M
R35 1M
R34 1M
C16 .01 1kV
C15 .01 1kV
C17 .22
D10
R40 470K
R41 1M
¼ 3302
U1D
AUXILIARY
9-VOLT BATT
1N4001 D19
ON
OFF
SW2
AUDIO
C5 33 10V
R13 274K 1%
C4 .01
R11 100K
½ 14538
U2B
X1 CAL
X10 CAL
X100 CAL
R14 4.99M 1%
R15 5M
R16 499K 1%
R17 500K
R18 49.9K 1%
R19 50K
R20 10K
U8D
U8C
U8B
U8A
C10 .22
C9 1.0
C12 .047
C14 220pf N750
D8
D9
C13 .22
CA3160
U4
R31 50K
METER ZERO
R29 82.5K 1%
R28 500 1%
SPAN
R30 249 1%
R32 1M 1%
R33 11K 1%
U7A
U7B
U7C
U7D
N/C TP-1
A



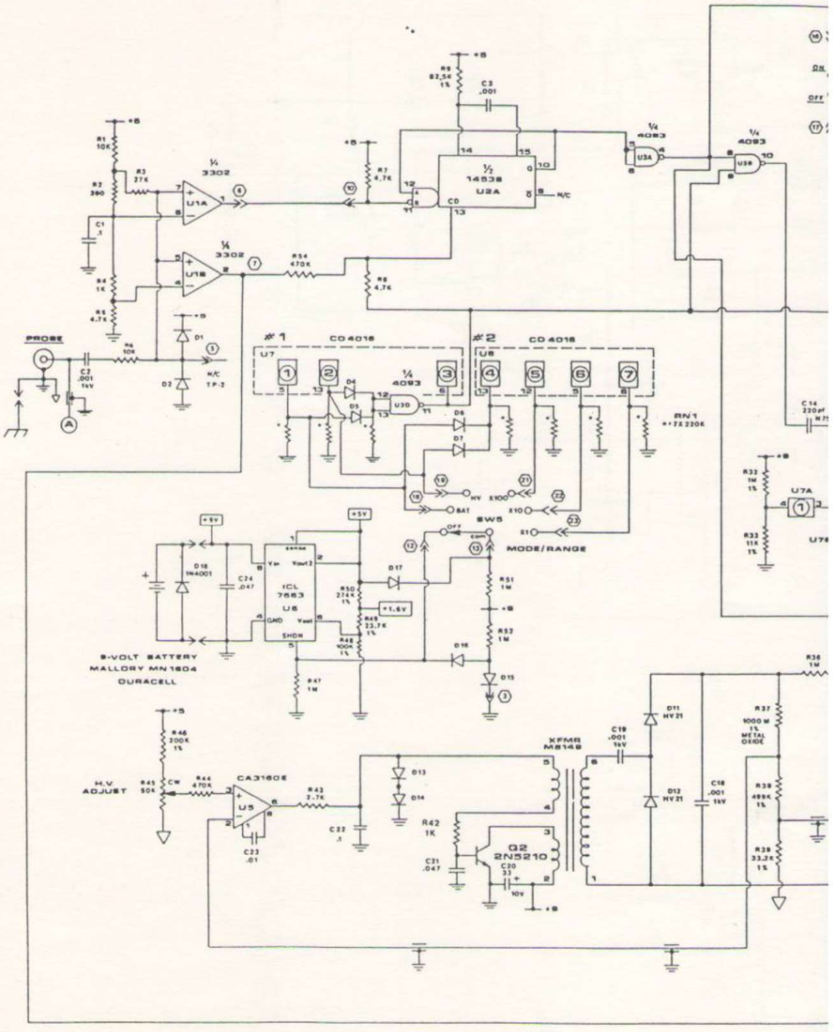
TOLERANCES UNLESS OTHERWISE SPECIFIED
FRAC. ±
.XX ±
.XXX ± ~
ANGLES ± °
MICRO FIN √

SCALE None
DRAWN Dudeyl
DATE 10 20 92
CHECKED JR
DATE 11 17 93
DO NOT SCALE PRINT
FINISH SPEC

BICRON
CORPORATION
NEWBURY, OHIO U.S.A.

Schematic Circuit Diagram
Surveyor AHS
DRWG NO
REV

PATENT PENDING
REV
DATE
DESCRIPTION
BY
DE BURR & BREAK


PROBE
R1 10K
R2 390
R3 27K
C1 .1
R4 1K
R5 4.7K
R6 10K
C2 .001 1kV
D1
D2
N/C TP-2
A
¼ 3302
U1A
U1B
R54 470K
R7 4.7K
R8 4.7K
R9 82.5K 1%
C3 .001
½ 14538
U2A
CD
N/C
¼ 4093
U3A
U3B
#1
CD 4016
U7
#2
CD 4016
U8
U3D
D4
D5
D6
D7
RN1 *=7X 220K
HV
BAT
X100
X10
X1
SW5
OFF
com
MODE/RANGE
+9V
+5V
D18 1N4001
C24 .047
ICL 7663
U6
Vin
Vout2
GND
Vset
SHDN
R50 274K 1%
R49 23.7K 1%
R48 100K 1%
+1.6V
R47 1M
D17
R51 1M
R52 1M
D16
D15
9-VOLT BATTERY
MALLORY MN1604
DURACELL
R46 200K 1%
H.V ADJUST
R45 50K
CW
R44 470K
CA3160E
U5
R43 2.7K
C23 .01
C22 .1
D13
D14
XFMR M8149
R42 1K
C21 .047
Q2 2N5210
C20 33 10V
C19 .001 1kV
D11 HV21
D12 HV21
C18 .001 1kV
R36 1M
R37 1000 M 1% METAL OXIDE
R38 499K 1%
R39 33.2K 1%
C14 220pf
R32 1M 1%
R33 11K 1%
U7A
ON
OFF